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Theories of play have identified many ways in which play may advance children's development. Yet, much traditional childhood play is being replaced by time spent on computer play. However, such computer programs are often produced without theoretical foundation, using animations, colour, sound, and surprise as the basis of their design rather than pedagogical principles or theories. This study explores the affordances of different types of computer play in enhancing children's traditional developmental play. A number of computer games designed for young children were selected on the basis of criteria developed from an extensive literature analysis. This study presents analysis of a preliminary study in which two young siblings were observed playing the selected games in a variety of settings, including their natural home environment.

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The affordances of computer play in young children: A preliminary study

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Abstract:

Theories of play have identified many ways in which play may advance children's development. Yet, much traditional childhood play is being replaced by time spent on computer play. However, such computer programs are often produced without theoretical foundation, using animations, colour, sound, and surprise as the basis of their design rather than pedagogical principles or theories. This study explores the affordances of different types of computer play in enhancing children's traditional developmental play. A number of computer games designed for young children were selected on the basis of criteria developed from an extensive literature analysis. This study presents analysis of a preliminary study in which two young siblings were observed playing the selected games in a variety of settings, including their natural home environment.

Introduction

The rapidly growing market of computer games for young children merits a re-examination of their manner of use and their facility to provide opportunities for children's development. Described by Salonius-Pasternak and Gelfond (2005, p. 6) as 'the first qualitatively different form of play that has been introduced in at least several hundred years,' computer play is ubiquitous, widely-accepted yet under-researched.

Whilst there is still a debate about the advantages and disadvantages of young children's computer use (Alliance for Childhood, 2002), increased computer access for children in today's Australian homes and childcare centres has become a reality. According to the Australian Bureau of Statistics, in 2006-07, 64% of Australian households had home Internet access and 73% had access to a home computer (ABS, 2007) and 'for 5 to 8 year olds, playing games was the most common activity undertaken using a home computer' (ABS, 2006). There is an increased number of software packages aimed at children as young as one or two years. Currently, Early Childhood Australia's Position Statement on information and young children (ECA, 1997, under review) emphasises the importance of 'an analysis of information technologies regarding their appropriate use' but differentiates between only two types of software, educational and entertainment and does not include children's play in reference to technology. Nevertheless, the US National Association for the Education of Young Children (NAEYC) emphasises the importance of children's play in early childhood in relation to computer technology, stating that 'the computer is likely to serve best when it extends natural play' (NAEYC, 2008).

We know from existing research that computer games can be useful in enhancing children's memory capacity, attention span, and problem solving strategies, which can, in turn, affect their academic achievements (Haugland, 1992; Amory et al., 1999; Flintoff, 2002; Green & Bavelier, 2003; de Aguilera & Mendiz, 2003; Doolittle, 1995). What we don't know is whether and how computer games used by very young children affect their ability to act out make-believe, how such activities can be recognised in computerised form, and whether they might constitute forms of developmental play.

There is a significant gap in understanding the ways that computer games as a new form of play can be related to young children's spontaneous play. This study makes a first step in investigating the characteristics and features of computer games which can support and enhance children's make-believe play and at the same time enrich the developmental value of computer play. The aim of the study was to explore the *affordances* (the fundamental properties that determine how something can be used, or specific enabling features or characteristics, cf., Norman, 1988) of different types of computer games in supporting and enhancing the developmental value of traditional play in young children. Affordances that support children's development in ways that are not possible in traditional child's play were also explored.

The developmental value of children's play

Play occupies a significant part of young children's life. From an early age they engage in make-believe pretending, for example, that a stick is a spoon and a block is an iron. In playing "mothers and fathers", or "doctors and nurses" children enact a variety of roles and follow the rules they imply. The dimension of pretend, that is, an action and interaction in an imaginary, 'as if' situation, is viewed as an essential characteristic of children's play which contributes to children's psychological development (Leontiev, 1981; Bodrova & Leong, 1996). Acting in an imaginary situation of make believe play constitutes the basis for the child's awareness of the world around them, and raises their cognition of reality to a more complex and generalised level. This, argued Vygotsky, sees the beginning of higher mental functioning and abstract thought (Vygotsky, 1978). Recently it has been argued that 'children's play, especially in its make-believe or pretending game forms, is a critical precursor to a major feature of our adult narrative consciousness' (Singer & Singer, 2006, pp. 97-98).

Emphasising the significance of pretend play in children's development, socio-cultural theorists describe it as a "leading" activity of the early childhood years (Vygotsky, 1967; Leontiev, 1981) which means that the most significant psychological achievements of the early childhood age occur while children engage in play.

Considering the importance of children's traditional play for their development, it is important to study computer play as a form of child's play and consider how the developmental benefits of such play can be supported and enhanced by modern technologies. As pointed out by some researchers, and in the words of Reiber (1996) 'the time has come to couple the ever increasing processing capabilities of computers with the advantages of play' (p. 43).

Potential benefits of computer play

There have been a number of studies that have demonstrated the influence of computer play on cognitive development of upper primary or high school children and university students (Amory et al., 1999; de Aguilera & Mendiz, 2003; Flintoff, 2002; Cassell & Ryokai, 2001; Ko, 2002; Pillay, 2003 and others). Many studies examine the value of computer play for learning (de Aguilera & Mendiz, 2003). Computer games can be useful in enhancing memory capacity (Haugland, 1992; Amory et al., 1999; Flintoff, 2002), in attention span

(Green & Bavelier, 2003) and in the problem solving strategies of children (de Aguilera & Mendiz, 2003; Doolittle, 1995), which can, in turn, affect their academic achievements (Flintoff, 2002).

Yelland (2005) provides an overview of numerous studies that examine the use of computers in early childhood education. Research has demonstrated that the use of technologies can raise the level of early childhood curriculum so that 'young children can not only experience concepts that were previously well beyond that expected of them but that they could deploy sophisticated strategies and work collaboratively with others in new and dynamic ways in technological environments' (Yelland, 2005, p. 224). In particular, it was illustrated that computer software can provide advantages for teaching abstract mathematical concepts such as shapes which challenge the idea that the early childhood curriculum has to be predominantly based on the use of concrete materials. Research demonstrated pedagogical benefits in using computer based manipulatives for advancing children's ability in abstract thought (Clements, 2002). Even though the early childhood curriculum is traditionally based in play (Van Hoorn et al., 2003), the majority of considered studies are focused on the use of computers to enhance learning in a particular curriculum area or to develop some basic cognitive skills, rather than forms of play itself.

In regards to children's play it was concluded that 'the manipulation of symbols and images on the computer screen represents a new form of symbolic play, in which children treat the screen images as 'concretely' as they do the manipulation of any alternative blocks and small-world toys' (Brooker, 2002, p. 269, in Yelland, 2005, p. 221). This study indicates that there is potential for further exploration of the affordances of computer play in the development of children's ability for higher order thinking.

Early childhood educators talk about developmentally appropriate use of computer technologies (Downes, Arthur & Beecher, 2001). They suggest that to be effective, computer software should be designed in a pedagogical manner suitable for young children, that is, create an environment where children can play, explore, investigate, look things up, solve problems, and do puzzles and other activities which promote communication, interaction, discovery and problem solving (Downes et al., 2001, p. 144).

Categorisation of computer games

At present, there is no standardized categorisation for genres of computer games. Modern computer games tend to blur across categories or are best described using two or more categories in combination. One of the most complete and inclusive taxonomies can be found at Wikipedia.com under the topic, video game genres. Based on an analysis of the Herz (1997) and Wikipedia systems, it categorises games in terms of their educational value. It distinguishes three major categories of games: some games may be designed purely for the purpose of *education*, some for *entertainment*, and others for something in between. It is the in-between games, the *edutainment* games, that are of most interest for researchers of computer play in early childhood as they combine the features of recreational play with some educational purposes. This category includes simulations, puzzles, adventure and strategy games as well as role playing and

sports games. Current research suggests that adventure (Amory et al., 1999; Dawes & Dumbleton, 2001; Pillay, 2003; Sandford & Williamson, 2005) and simulation (de Aguilera & Mendiz, 2003; Gredler, 2004; Kirriemuir & McFarlane, 2003; Sandford & Williamson, 2005; Squire, 2002) games may offer the most promise for education.

The study

This paper presents the results of a pilot study which involved two siblings, Joshua, 5, and Bronte, 7 (pseudonyms used), systematically observed as they engaged with a number of different computer games. The data gathering and analysis was based in the standard techniques of child's play observation: the children's speech samples and behavioural episodes were noted, in particular those that indicated their engagement in imaginary play (e.g., undertaking the roles of others, variations in labelling the situations and objects, interactions with peers and adults about situations of pretend).

The study was conducted in three consecutive stages: 1) identification of criteria for computer games selection based on literature analysis; 2) review and selection of computer software; 3) an empirical study of children's engagement with different kinds of play identified in previous stages.

In Stage One a literature analysis was undertaken in order to explore current research and theory on the affordances offered by different kinds of computer play in assisting children's and young adults' cognitive development (a more complete discussion of the findings of this stage is presented in Verenikina, Herrington, Peterson & Mantei, 2008). A list of preliminary criteria was created on the basis of the literature which explored the characteristics of computer games that promote higher order learning through play. Such criteria included: computer play is intrinsically fun and is not limited in scope to 'teaching' particular skills; it includes play for the sake of play where reaching goals is less important; it relates to daily life; is discovery-oriented; allows children choices in selection and timing of activities; allows the manipulation of symbols and images on the computer screen; provides the facility to engage collaboratively with the program; provides visible transformations; enables increasing complexity; provides spoken directions and/or advice. An additional criteria, not identified in literature but a key focus in the research study, was children's engagement in make-believe, pretend play, that is undertaking roles and/or acting in a situation of pretend (more detailed description presented in Peterson, Verenikina & Herrington, 2008). The above characteristics can be present in any types of games, but mostly in simulations which allow for engagement in a situation of pretend and make-believe play.

Stage Two focussed on identifying and selecting the software for young children which matched the criteria developed in the previous stage. The software was searched through the *Children's Technology Review* (Active Learning Associates, 2007); individual experiences of the researchers and their colleagues and friends, as well as searching software in major Australian retailers selling software for young children such as *Harvey Norman*. Additionally, the favourite games of the participants were considered for the selection. The search indicated that none of the available software programs fully met

identified criteria, therefore the choice was made from those of the closest match. The chosen games represented a variety of categories in *edutainment games*. Such games included *Pajama Sam* and *Spy Fox* (adventure/ action); *Jump Start* (puzzle/action); *Dogz* and *SimCity* (simulations).

Stage Three, the observation and analysis stage, was focussed on children's engagement with the software identified in Stage 2. Over a period of three months, the children were observed and videotaped (altogether 12 sessions of approximately 45 – 50 min each). Three locations were chosen iteratively to enhance the nature of the play experience for the children, and the quality of the data collection. Two initial sessions were conducted in a University classroom setting with each child playing on separate adjacent computers. While children were playing individually their computers were positioned close to each other so that they could engage in communication with each other if they wished. This was important as it is most likely that children engage in play when interacting with other children (Pellegrini & Bjorklund, 2004). The children's mother, a teenage helper who knew some of the software, and the researchers were available to help the children with the games. The room was not equipped with recording technology and it required additional time and resources to set it up. The next two sessions were conducted in a usability laboratory, located at the Faculty of Commerce, University of Wollongong, and equipped with good quality video recording and observation system. In the usability laboratory, the children were able to play games without the researchers being in the same room. However, our observations demonstrated that children did not feel comfortable without help and they needed assistance to keep them going. Thus, a researcher had to join them. According to our observations in both the University venues children did not engage in play in a naturalistic way, and we did not observe any episodes of their engagement in pretend play when playing *Pajama Sam*, *Spy Fox*, *JumpStart* and *Dogz*.

The rest of the sessions were observed and videotaped in the children's home by their mother where children engaged in computer play in a natural way. The mother was asked to videotape a number of sessions of her children playing computer games as well as write observational field notes of any relevant episodes which she could not videotape. In particular, she was asked to observe her children engaging in any make-believe play episodes which were relevant to the content of the computer games. This data gathering method has been previously used by Smith (2002) where a mother acted as a researcher of her own young child mastering a computer program.

The method of data gathering by a parent in an authentic home setting proved to be successful for the purposes of our research as it allowed the documentation of a number of episodes of children's engagement in pretend play which could not have been captured in a laboratory setting. For example, Joshua carried the character of *Pajama Sam* into his everyday play. His hair and dress were mimicked, he arranged his room to look like *Pajama Sam*'s room and he modelled many of the character's behaviours, such as running and jumping off stairs, and using a torch in dark spaces. Another example of engagement in pretend play was documented when the children played *Dogz*, a simulation game which allowed children to create and take care of

their own virtual pet dog. Once the children mastered the main elements of the game and were able to engage in it at their own pace, Joshua and Bronte, together with their older sister Lizzy created a make believe environment, best described as a 'community of dog owners': each of the children had their own pet-dog, which they named and looked after. They seemed to engage in make-believe episodes on a regular basis, coming back to it in everyday conversations with each other. For example, Joshua began a conversation with Bronte by asking 'Do you have a suit of armour for your dog?' to which, Bronte replied, 'No, I got the big hat instead because I am going outside to the backyard'. Later on they included in this on-going make-believe play characters that they created in the Nintendo version of *Dogz* thus owning a number of dogs each. They 'looked after' each other's dogs, taking them for walks and giving them treats. They were also observed using each other's dogs during sibling disagreements, making comments such as 'I will take Ruby [the sibling's virtual dog] for a walk until she is tired and hungry and then I won't give her any food!'

Similar episodes of pretend play, transferred from computer play into real life communication, were documented when children played a version of *SimCity* computer game. For example, the game has an initial 'God' mode, where players create the worlds they wish to inhabit, and both children spent a great deal of time creating and re-creating these worlds. Once children played the game several times, the children's mother observed multiple instances of their talk involving the game, such as talking about what they had created in 'God' mode.

Conclusion and future research

Preliminary analysis of the data demonstrated that there are opportunities for engagement in make-believe play that exist in the playing of computer games. In all three games described here, ample opportunities presented for young children to explore the environments in imaginative and make-believe ways, both within the games and beyond them to their everyday play. However, children seem to be able to engage in make-believe only after they have mastered the basic level of the game. It cannot be expected that children engage in make believe from the very first session they play the game. Additionally, it appears that it is simulation games (e.g., *Dogz*, *SimCity*) which allow children to engage in make-believe within their play away from technology.

In terms of the research methodology and data collection locations, a few lessons have been learnt which need to be taken into account in future study. The research indicated quite strongly that observations of computer play need to be made in a naturalistic setting of the home environment where children can freely engage in computer play by their own choice. Observations need to be conducted by a child's parent or another family member who is constantly in contact with children and can observe their behaviour in a variety of home contexts. Make believe in which children engaged in our research went beyond the computer play and could not have been captured in a laboratory setting. A similar point was made by Carrington and Marsh, who suggested that the study of children and youth computer gaming should be carried beyond the play at the computer itself, 'on

and off screen' (2005, p. 282), as children extend their play into real life situations. The data also suggest that make believe is at its best when children play as a group: children need shared experience of engaging in computer play and communication with each other to create complex scenarios and transfer them beyond the computer game itself.

While the outlined implications for research methodology, such as the need for time to familiarise with the game and the comfort of play within the home environment, are significant for studying young children, it also may translate more widely, into research of technology use by a variety of age groups of children.

As a future implication of our research, criteria for evaluating computer games can be utilised as a framework for designing developmentally appropriate software for young children regarding the software that sits between learning and entertainment. There appears to be no systematic approach to the design of computer play for young children which aims to capitalise on the developmental value of children's traditional play. There is an urgent need to develop such an approach which is theoretically-based and recognises the importance of developmental play in children's development. If computers do provide opportunities for 'qualitatively different play' as suggested by Saloni-Pasternak and Gelfond (2005), it is important for researchers to examine the quality of computer-based play, and investigate the opportunities and affordances that such play provides for the development of young children.

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